



Barriers to Repair:

iFixit Evidence for the House Judiciary Right to Repair Hearing

July 14, 2023

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Executive Summary

Not long ago, repair was most Americans' default course of action when something failed: Repair shops abounded, appliances came with circuit schematics and parts catalogs, and you could open most things with a common screwdriver. But **our things have become increasingly difficult to open and service**. Parts have become scarce. Software has begun to restrict access to repair. Too often, people assume these changes are a technological necessity. Manufacturers lean on the fiction that computational complexity requires them to restrict repair to their own services.

On the contrary, the increasing difficulty of repair is a deliberate manipulation of the market. There has been a **massive, multi-industry push by large corporations to develop and maintain a monopoly on repair**—with similar strategies evident in agriculture, consumer technology, appliances, vehicles, and medical devices. Repair is, for many manufacturers, a big business. Keeping repair in-house lets them tie repair service to product sales and push consumers to replace instead of repair whenever possible. Anticompetitive repair restrictions on parts, tools, diagnostics, and software funnel consumers to manufacturer-authorized service centers. At these centers, repair prices are often deliberately set right at the point where research finds customers will decide instead to buy new. Repair restrictions thus **hurt independent businesses, cost consumers money by driving up the cost of repair, and result in unnecessary toxic waste** when electronics end up in landfills.

The effort to remove these restrictions on repair is called **the Right to Repair movement**. Right to Repair laws have been introduced in 45 states, and six state Right to Repair bills have passed:

- Massachusetts passed the [Automotive Right to Repair Act](#) via direct ballot in 2012.
- Massachusetts passed the [Vehicle Data Access Requirement ballot initiative](#) in 2020.
- Colorado passed the [Consumer Right to Repair Powered Wheelchairs Act](#) in June 2022.
- New York passed the [Digital Fair Repair Act](#) covering consumer electronics, also in June 2022. It applies to new products made after July 1, 2023 and goes into effect January 1, 2024.
- Colorado expanded their [Right to Repair statute](#) to include agricultural equipment In April, 2023.
- Minnesota passed the broader [Digital Fair Repair Act](#) that covers appliances, consumer electronics, and enterprise technology in March, 2023. It is retroactive to products made after July 1, 2021.

Federal interest in Right to Repair has also grown. In 2021, President Biden [signed an executive order](#) promoting competition, encouraging the FTC to establish rules supporting the right to independent and DIY repair. The [FTC conducted an investigation](#) and concluded in mid-2021 that there is significant evidence of repair restrictions and “no substantial evidence” supporting manufacturers' counterarguments.

In the 2021-22 session, repair was the subject of **five Federal Congressional bills**, many of which were bipartisan.¹ These bills addressed a wide range of product categories, including general consumer electronics, agricultural equipment, and automobiles. They addressed repair restrictions in the form of enabling access to parts and tools (Fair Repair Act, Agricultural Right to Repair Act), ensuring the availability of necessary data and software (REPAIR Act, Agricultural Right to Repair Act), and removing copyright restrictions that unfairly limit repair (Freedom to Repair Act).

The House Committee on Small Business Subcommittee on Underserved, Agricultural, and Rural Business Development held a hearing called “Right to Repair and What it Means for Entrepreneurs” on September 14, 2022.²

In 2023, Congressman Neal Dunn reintroduced the REPAIR act, ensuring that automobile owners have access to the data they need to complete repairs.³ We anticipate that at least a couple of the other Right to Repair bills from the last Congress will be reintroduced.

We call on Congress to take action in support of Right to Repair by learning about the impact of repair restrictions on consumers and small repair businesses, by passing the bill before them, and by introducing and cosponsoring further legislation on this issue.

Most legislation has been focused on requiring manufacturers make tools available to independent repairers. A free market alternative would be to foster a marketplace of competitive tools that provide alternatives to manufacturer repair solutions. Unfortunately, those tools are currently illegal under Section 1201 of the DMCA.

It is **especially crucial that Congress address the copyright restrictions** preventing repair tools (covered last Congress by the Jones-Spartz House Freedom to Repair Act), as these restrictions can only be lifted at the Federal level.

Through iFixit’s position—offering a free open-source online repair manual and working with independent repair businesses—we have encountered **evidence of a wide variety of repair restrictions**. In this document, we enumerate those restrictions, record the evidence we’ve gathered, and share the rationale for our support of Right to Repair legislation.

¹ The [House Fair Repair Act](#) (Khanna, Norton, Meng, Panetta, Bonamici, Porter, Malinowski); the [House Freedom to Repair Act](#) (Jones, Spartz, Porter, Stansbury, DeGette); the [House REPAIR Act](#) (Rush, Davidson, Jones, Dunn, Reed, Boyle, Thompson, Evans); the [Senate Fair Repair Act](#) (Lujan, Lummis, Wyden); and the [Senate Agricultural Right to Repair Act](#) (Tester)

² <https://docs.house.gov/Committee/Calendar/ByEvent.aspx?EventId=115093>

³ <https://dunn.house.gov/press-releases?id=433DA033-E6FE-4088-9A40-9F078A10717D>

iFixit's 75 Million Users Encounter Repair Restrictions

iFixit is an international, open-source, online **repair manual for everything**. Our mission is to provide people with the knowledge they need to make their things work for as long as possible.

We represent a global community of makers, tinkerers, fixers, and repair professionals. In 2022, the iFixit community taught repair to over 75 million people from almost every country in the world. The strongly collaborative group has published over 90,000 repair guides. This massive, free resource has helped people fix **everything from cellphones and game consoles to tractors and wheelchairs**.

Many people who come to iFixit are looking to fix something themselves because repairing it at home is cheaper, more secure, and more convenient than other possibilities. Some live hours away from manufacturer repair options. Others have visited manufacturers' repair centers and been told their device was unrepairable, or that repair would cost nearly as much as a new device. Often **our users are able to prove the manufacturers wrong** by repairing their things affordably.

iFixit also supports independent repair businesses, as well as IT departments at schools and government agencies, by providing free repair documentation and offering wholesale parts and tools. The owners of these businesses frequently describe how manufacturers' repair restrictions hamper their ability to compete in the marketplace. They often cannot get reliable parts or the tools they need to complete repairs consistently.

Increasingly, both individuals and independent repair businesses encounter repair restrictions even after installing a new part: Manufacturers have begun to pair parts via serial number with other parts, which means that error-free repairs require the use of pairing software that manufacturers keep proprietary. We hear from repair business owners about **stacks of broken devices piled in their back rooms**, unrepairable only because of these software limitations.

For our members—and American consumers more generally—the problems of being unable to repair their things are vast and will continue to grow, unless legislators **introduce common sense regulation to restore competition in the repair market**.

A Brief History of Right to Repair

Local shops are the place to take your car for most fixes. That's largely due to the foundational laws of the Right to Repair movement: the [Clean Air Act Amendments of 1990](#) and the [Motor Vehicle Owners' Right to Repair Act](#) of 2012.

The 1990 Amendments demanded that every US car be able to monitor its own emissions by 1996. In order to do that, repair shops needed a standardized way to interface with the car's monitors. [Thus was born the OBD-II port](#), which ensured that you don't have to pay a ransom to the dealer for every Check Engine light.

But cars continued to get more complicated, and companies more secretive, after 1996. Massachusetts residents responded by voting in a repair-minded ballot initiative in 2012. After that, the major trade groups representing car makers (except Tesla) [agreed to incorporate the initiative as a national standard](#), rather than wait for a patchwork of state bills to follow. Now

repair shops can access the same diagnostic tools and data as dealerships, beyond just the OBD-II port. Before this legislation and the more even playing field it created, car makers had an incentive to exaggerate the danger or uncertainty of “unapproved” repairs.

In early 2012, Nikon [sent a letter to their independent service network](#). Nikon flatly stated that they would no longer supply repair parts to anyone—except 23 Nikon authorized repair facilities. In one fell swoop, Nikon secured for itself an absolute monopoly over the repair of their products. And it put thousands of qualified, established camera repair technicians out of business.

In January of 2013, invoking Section 1201 of the DMCA, at the recommendation of the Copyright Office, the Librarian of Congress effectively banned unlocking cellphones without the permission of the carrier. His reasoning: that modifying a phone's programming was a violation of US copyright law. The effect: cellphone refurbishers wouldn't be able unlock cell phones for reuse. Members of this coalition banded together with other advocates and fought to re-legalize cell phone unlocking. On August 1, 2014, President Obama [signed unlocking legislation](#)—ensuring that both consumers and refurbishers would be able to unlock phones.

States [began introducing](#) electronics Right to Repair legislation authored by Repair.org in 2014. Starting in [South Dakota](#), forty-five states have introduced a variety of measures to restore competition in the repair marketplace. So far, [four states have passed](#) Right to Repair legislation:

Massachusetts	<p>Motor Vehicle Owners’ Right to Repair Act (2012)</p> <p>Massachusetts voters overwhelmingly passed the nation’s first Right to Repair law, focused on automobiles, in 2012. The ballot initiative passed with 87.7% of the vote, or 2.4 million votes, and it required automobile manufacturers to make non-proprietary diagnostic and safety information available to consumers and independent repair shops. After the bill passed, automotive manufacturers worked with the Auto Care Association to extend those same protections across the country via a memorandum of understanding, as long as advocates promised not to push for any more automotive state Right to Repair bills.</p>
	<p>Right to Repair Vehicle Data Access Requirement Initiative (2020)</p> <p>The 2014 memorandum of understanding between the Auto Care Association and automotive manufacturers explicitly excluded telematics data—the systems cars use to track fuel consumption and braking, among other things. But in today’s increasingly connected vehicles, diagnostic information is more and more often passed via telematics systems. So Massachusetts voters overwhelmingly passed another initiative that would require manufacturers to provide telematics data, too. Automakers immediately sued to stop the implementation of the law, but in March 2023, Massachusetts Attorney General Andrea Joy Campbell said she will begin to enforce it despite the ongoing lawsuit.</p>

<p>Colorado</p>	<p>Wheelchair Right to Repair (2022)</p> <p>In 2022, Colorado passed HB22-1031, Consumer Right to Repair Powered Wheelchairs. The bill gave wheelchair users and independent repair technicians access to the same repair parts, tools, and documentation that manufacturers’ authorized technicians have. Within days of its enactment, Coloradans were making use of their new freedoms, getting access to chair-adjusting software that they’d previously been denied.</p>
	<p>Agricultural Right to Repair (2023)</p> <p>Colorado passed the first-ever agricultural Right to Repair protection in 2023: HB23-1011, Consumer Right to Repair Agricultural Equipment. Like the powered wheelchair bill passed the year before, it protected consumers’ and independent technicians’ access to the same parts, tools, and documentation as manufacturers’ authorized technicians. When the bill goes into effect on January 1, 2025, it will bust a decades-old repair monopoly on farm equipment—a monopoly that Americans have paid for via higher food prices.</p>
<p>New York</p>	<p>Electronics Right to Repair (2022)</p> <p>New York’s electronics Right to Repair bill, S4104-A/A7006-B, passed the state legislature in June 2022 with strong consumer protection—but by the time the governor signed it in December 2022, it had been weakened significantly due to manufacturer lobbying efforts. For example, it excluded enterprise IT equipment. Manufacturers are also allowed to combine inexpensive components into large assemblies, which can price repair out of reach for many consumers. They are also not required to license their intellectual property, which may mean that they can continue to block repair via software parts pairing (depending on how the state attorney general interprets the law). Still, the bill will require manufacturers to make some parts, tools, and documentation available.</p>
<p>Minnesota</p>	<p>Digital & Appliance Right to Repair (2023)</p> <p>Minnesota passed broad Right to Repair reforms as part of an omnibus bill in 2023, covering all electronics, with only a small handful of exceptions (farm equipment, video game consoles, specialized cybersecurity tools, motor vehicles, and medical devices). Otherwise, everything with a chip is covered, from smartphones and laptops to appliances and networking equipment. Manufacturers of all these products will be required to provide owners and independent repair shops with the same parts, tools, and documentation that they provide their authorized repair providers. The law goes into effect on July 1, 2024, and applies to anything produced after July 1, 2021.</p>

Bipartisan FTC Investigation and Action in Support of Repair

In May 2021, the Federal Trade Commission released the unanimous, bipartisan [“Nixing the Fix: An FTC Report to Congress on Repair Restrictions.”](#) which describes their three-year investigation of barriers to repair across industries, potential legislative and regulatory fixes, and arguments made on both sides of the Right to Repair debate. The report grounds itself in discussion of the Magnuson-Moss Warranty Act’s Section 102(c), the anti-tying provision, which prohibits manufacturers from conditioning a warranty on consumers using only manufacturer-provided parts or service. The report concludes:

Based on the record before us, it is clear that repair restrictions have diluted the effectiveness of Section 102(c) and steered consumers into manufacturers’ repair networks or to replace products before the end of their useful lives. Based on a review of comments submitted and materials presented during the Workshop, **there is scant evidence to support manufacturers’ justifications for repair restrictions.** Moreover, the specific changes that repair advocates seek to address manufacturer repair restrictions (e.g., access to information, manuals, spare parts, and tools) are well supported by comments submitted for the record and testimony provided at the Workshop.

Following this report, the FTC has ramped up enforcement, worked with state legislators to develop more-effective Right to Repair legislation, and in 2023 sent its Chief Counsel for Development and Innovation, Dan Salsburg, to [testify in front of the California legislature.](#)

More Repair Would Make America Better

We need to make our products last longer—doing so will create jobs, reduce waste, and help keep expertise onshore and local.

We’re using too many resources to make short-lived electronic products. Unsustainable mining practices [ravage the environment.](#) Electronic waste ends up in [landfills](#) and [waste dumps](#) around the world. Usable products and device components are scrapped instead of salvaged, fixed, and reused.

The material and human cost is significant. We can improve [working conditions](#) in factories, restrict mining companies from [dumping toxic wastes](#), limit exports of electronic waste, and tighten enforcement of [laws keeping electronics out of landfills.](#) But that will not stem the tide of obsolete devices. It will treat the symptoms but do nothing for the cause of this crisis.

Making products last means optimizing not only for the first owner, but also the third, the fourth, and the fifth owner by encouraging informal reuse and repair.

Reuse is an Economic Growth Engine

The Bureau of Labor Statistics estimates there are 325,400 electronics and mobile equipment repair technicians (working in repair-related NAICS codes) in the US. Additionally, there are hundreds of thousands of service technicians in informal repair markets around the world—in places like Guangzhou and Shenzhen—that import used electronics from the US for repair and resale. They are able to perform repairs not possible in the US. These technicians are more skilled at the repairs because they have local manufacturing expertise and access to service

documentation and circuit schematics. Decriminalizing access to those schematics would open a pathway to domestic economic growth.

Repair jobs have been lost in many markets as product replacements (particularly consumer products) drop demand for repair. Fortunately, iFixit's community has collaboratively closed some gaps in the manufacturer's planned obsolescence strategy. Thousands of cell phone and tablet repair shops using iFixit repair guides have sprung up around the country in the last few years—representing tens of thousands of new jobs.

Environmental Benefits of Repair

Repairing and refurbishing electronics has tremendous potential to impact sustainability. A [report](#) by McKinsey & Company and the Ellen MacArthur Foundation⁴ found that increasing reuse and refurbishment could reduce the production of emissions of mobile phones by 3 million tons of carbon dioxide. Currently, market experts estimate that only 15% of smartphones are recycled—the rest are either put in storage or thrown away. According to McKinsey, increased resale of refurbished cell phones alone could generate \$9.4 billion USD in additional economic opportunity annually. If we don't facilitate that economic growth here at home, it will happen overseas.

The US electronics recycling industry is substantially funded by repair and resale. Electronics recyclers were a key driver behind passing the Unlocking Consumer Choice and Wireless Competition Act in 2014. On the surface, that bill was a modification to Section 1201 of the DMCA and had nothing to do with recycling. But [recyclers](#) are some of the [largest volume repairers and exporters](#) of smartphones in the country.

An Illinois Economic Activity survey⁵ showed that repairing electronics creates 13 times as many jobs as recycling it. A growing contingent of electronics recycling facilities have sophisticated repair and refurbishment operations. Recyclers, thus, face the same problems that repairers do: They struggle with access to information, parts, and tools necessary to operate their refurbishment operations. But recyclers also face some unique challenges. For instance, they need information about where embedded batteries are located, because if lithium-ion batteries enter a shredder, they can start a facility fire. Unlike repairers, who can call a device's owner to bypass security locks that might impede repair, recyclers interested in refurbishing all too often encounter anti-theft cloud activation locks. These locks result in products getting shredded instead of repaired.

It's prohibitive to expect recyclers to pay each manufacturer for information, translate the documentation, and convert it into a standardized format for use in their content management systems. Recyclers, consumers and reuse centers alike need access to standardized service documentation at no charge for the complex electronic equipment they own.

⁴ McKinsey & Company. "Towards the Circular Economy: Economic and business rationale for an accelerated transition" Vol. 1. <http://www.ellenmacarthurfoundation.org/business/reports/ce2012>

⁵ Illinois Department of Commerce and Economic Opportunity. "Electronics Recycling: Economic Opportunities and Environmental Impacts" <http://www.illinoisbiz.biz/NR/rdonlyres/8DD41FE3-A7ED-4447-87C0-DD05815F2747/0/EwasteFactSheet.pdf>

[Guidelines on electronics reuse](#) released in April, 2012 by respected engineering association VDI⁶ found that it was “absolutely necessary” to adopt policies to support reuse of electronics. The study found that cannibalization of new product sales would not occur because “the markets of new products and reused products can be well differentiated from one another.” VDI also identified social opportunities for reuse: “An increasing number of companies offer work to disabled people by refurbishing electronic data processing technology.” For this reason, it is important that service information be made available in a blind/screen-reader friendly, standardized electronic format accessible to people with disabilities.

But there is insufficient research into interface, product, and systems designs that facilitate repair. It’s imperative that we strengthen repair infrastructures, institutions, and practices.

We’ve exported the manufacturing and engineering, but we’ve also inadvertently lost the knowledge to repair in the process. Technicians here don’t have the information they need to repair complex electronics. Every broken electronic that is exported without being repaired is a lost opportunity for job creation. It’s time to get that know-how back in America where it can create jobs.

Intellectual Property and the Right to Repair

Over the twenty-five years since the DMCA was passed, we’ve gone from a world where software is rarely seen outside of a general-purpose computer, to a world where billions of microprocessors are embedded in virtually every type of device. As a result, software has become central to the repair of devices.

Our physical objects aren’t just physical anymore. Code runs unseen through phones, watches, smoke alarms, and more. Without code, without software, our things become inert.

While this ushers in a whole new world of possibilities, it’s also redefining ownership. As these lines between physical and digital blur, it pits copyright and physical ownership rights against each other.

Manufacturers are, unfortunately, taking this opportunity to prevent users from repairing or modifying the devices they have bought, from tractors to printers to coffee makers.

Fixing Section 1201 of the DMCA

Section 1201 of the Digital Millennium Copyright Act makes it illegal to circumvent digital locks that control access to copyrighted content, such as DVD encryption, ebook and game DRM, and firmware with security protections. With software (and digital locks) embedded in virtually every type of device, Section 1201 effectively made it illegal to fix everything from game consoles to tractors to medical devices. The law is effectively double jeopardy: it’s already illegal to pirate software, but 1201 makes it illegal to break a lock to access the software.

What’s unique about the repair use case is that repairers need to bypass the lock, but generally have no need to duplicate the software. The need for reform Section 1201 is, at its heart, an effort

⁶ VDI. Dr. Ralf Brüning, et al. “Guidelines, electronic scrap recovery. ReUse of WEEE. VDI-2343 - Recycling of electrical and electronic equipment” <http://bit.ly/1ceCVjq>

to restore a critical aspect of consumer autonomy. Access to software tools and manuals for repair shouldn't be a high-stakes game of digital cat-and-mouse. When your repair is thwarted by a coded message on a digital screen, it's a chilling reminder that we're living in an age where companies can control our devices long after we've bought them.

Since 2015, iFixit has used the exemption process to fight for more freedom to fix. To get an exemption, every three years advocates and fixers participate in a laborious review process run by the US Copyright Office. If all goes well, the Register of Copyrights recommends and the Librarian of Congress grants temporary exemptions (which also have to be renewed every three years). In past review cycles we've won exemptions to let you fix your cars, tractors, smartphones, and home appliances, without fear of Section 1201's substantial civil and even criminal penalties.

In 2021, we argued that the Copyright Office should abandon its piecemeal approach of exempting very narrow subsets of device categories, and grant an exemption for the repair of all software-enabled devices. Whether you're fixing a toaster or a tablet, repairing isn't copyright infringement. They largely agreed, recommending exemptions for the purposes of "diagnosis, maintenance, and repair," of any "software-enabled device that is primarily designed for use by consumers," as well as repair of vehicles, marine vessels, and medical devices (including for accessing manuals and service information stored on the device!).

But the biggest problem is the lack of an exemption for repair tools: The rule does not allow you to distribute repair tools that circumvent manufacturers' digital locks. This is because without a change to the law, "The Librarian has no authority to adopt exemptions for the anti-trafficking prohibitions contained." So figuring out how to work around John Deere's tractor part-pairing tech is legal, but putting that code up on GitHub to freely share is illegal. Without access to shared tools, the exemptions are largely academic. Right now, if a farmer wanted to use this exemption to repair his tractor, they're going to have to [whittle their own](#) tractor unlocking app from scratch. That just doesn't scale—most farmers are not security engineers. The same is true of [gamers](#) who want to fix broken disc drives and McDonald's franchise owners who want to fix their broken [ice cream machines](#): If we want a fix to 1201 that enables repair, we need repair tools to be legal also.

One proposed statutory fix was the Lofgren-Massie [Unlocking Technology Act of 2015](#), which required a nexus to infringement to violate 1201. A more recent, narrower approach is the [Freedom to Repair Act](#) in the 117th Congress.

The Copyright Office has received [extensive argumentation](#) from both sides. The [Entertainment Software Association](#) and [Advamed](#) have opposed exemptions, suggesting that loosening copyright laws for repair would lead to rampant piracy—arguments we are accustomed to countering. In the 2021 rulemaking process, Morgan Reed, president of the App Association, suggested that if copyright holders can't (ab)use the DMCA to threaten hospitals and independent medical device repair technicians, patients will die, and entire regulatory systems will be undermined.

That would be news to the Food and Drug Administration (FDA), the agency that actually regulates medical devices. In 2018, the FDA [published a report](#) finding that repairs done by independent medical technicians are just as safe and effective as those by the manufacturer's

own technicians. Right on the first page of text, the FDA notes that third-party repair is “critical to the functioning of the U.S. healthcare system.”

The Copyright Office has generally loosened repair restrictions where it can, but it is running up against the limits of the statute. They [released a report](#) in 2017 recommending "expanding existing exemptions for security and encryption research and adding new provisions to allow circumvention for other purposes, such as the use of assistive reading technologies and the **repair of devices.**"

Reason, a Libertarian magazine, [wrote about manufacturer misuse of copyright in June 2018](#). Reason quotes Kit Walsh, attorney with the [Electronic Frontier Foundation](#), on the clash between strict copyright restrictions on software and living with software all around us:

“The list of products and technologies that are affected by this restriction is practically infinite because it’s anything that has software embedded in it,” says Walsh. “There’s a lingering hook that the seller has in your property that they are arguing gives them really broad powers to dictate how you use that property going forward.”

The Electronic Frontier Foundation [published a report](#) about the unintended consequences of Section 1201, concluding:

“The “anti-circumvention” provisions of the Digital Millennium Copyright Act (“DMCA”), codified in section 1201 of the Copyright Act, have not been used as Congress envisioned. The law was ostensibly intended to stop copyright infringers from defeating anti-piracy protections added to copyrighted works. In practice, the anti-circumvention provisions have been used to stifle a wide array of legitimate activities. As a result, the DMCA has become a serious threat to important public policy priorities.”

Everyone, including the Copyright Office, knows that the exemption process is a volatile, unpredictable way to reclaim our rights to fix the things we bought and own. You shouldn’t need to consult an attorney to understand whether it’s legal to fix the disc drive on your Xbox, or have a repair professional work past the lockouts on your tractor.

The Supreme Court Repeatedly Upholds Ownership Rights

The Supreme Court has repeatedly ruled that reuse and repair do not infringe on a manufacturer’s rights.

Copyright: In *Kirtsaeng v Wiley* (2013), they affirmed that a copyrighted work (like a book or a software program embedded inside electronic equipment) can be resold.

That’s important, because this case could have had far-reaching implications on the legality of reselling *any* product made overseas... which is pretty much everything.

Over \$2.3 trillion worth of foreign goods were imported in 2011 alone, SCOTUS reported. These days, everything—from cars to computers to cell phones—contains copyrighted materials. A ruling in favor of John Wiley & Sons could have made selling your iPhone on eBay or your Toyota on Craigslist illegal—a fact that influenced the court’s decision.

“A geographical interpretation would prevent the resale of, say, a car, without the permission of the holder of each copyright on each piece of copyrighted automobile software,” wrote Justice

Stephen Breyer. “[. . .]Without that permission a foreign car owner could not sell his or her used car.”

Patents: In *Lexmark v Impression* (2017), they again sided with product owners, ensuring that owners couldn't be prosecuted for patent infringement for reselling products (or parts of products). Impression Products wanted to make toner a bit cheaper by refilling Lexmark printer cartridges. Lexmark of course hated that and sued.

Impression Products vs. Lexmark International hinged on two points: Did Impression infringe upon Lexmark's patents by (1) reselling cartridges in the United States when Lexmark explicitly prohibited reuse and resale, and (2) importing without authorization cartridges Lexmark sold abroad. Various courts split on these questions, and everyone from the AARP and Huawei to Costco and the Auto Care Association weighed in when the case finally reached the Supreme Court.

"This case raises important questions about the reach of American patent law and how much control a manufacturer can exert after its products have been lawfully sold," the editorial board of *The New York Times* wrote in 2015. "Taken to their logical conclusion, Lexmark's arguments would mean that producers could use patent law to dictate how things like computers, printers, and other patented goods are used, changed, or resold and place restrictions on international trade."

"Take a shop that restores and sells used cars," chief justice John Roberts wrote in the majority opinion. "The business works because the shop can rest assured that, so long as those bringing in the cars own them, the shop is free to repair and resell those vehicles. That smooth flow of commerce would sputter if companies that make the thousands of parts that go into a vehicle could keep their patent rights after the first sale." No one besides the dealership would fix your car if it meant risking a patent lawsuit.

With the Supreme Court issuing definitive rulings on copyright and patent exhaustion, expect manufacturers to turn to contract law—like sneaky end user licensing agreements—to enforce their will. You already see it happening. John Deere, after losing a DMCA 1201 exemption fight to Repair.org, simply updated its EULA to block software modification in its tractors. Litigation dodged, problem solved. "They can't infringe upon your ownership rights if you've already signed them away," Gay Gordon-Byrne, director of Repair.org, told iFixit.

Arguments for Repair Options

Independent Repair Is an Effective, Safe Option for Consumers

If you haven't been to an independent repair shop, you're missing out on some true art. Take Steven and Nicole Spink, owners of [Olympia iPhone Repair](#) in Washington. They can seemingly fix anything—board-level repairs that Apple would refuse to perform are a piece of cake for them, and far less costly than replacing your device. (You can hear Nicole describe these challenges in [this Washington hearing on Right to Repair laws](#)—just skip to 6:40.) Unfortunately, without device schematics and other tools from Apple, they can't always do those jobs, causing them to lose business and forcing customers to pay much more for a full part replacement from Apple.

Manufacturers are focusing on one big lie in order to halt local repair: That you can't trust independent repair shops, only the manufacturers themselves.

Corporate lobbyists paint a bleak picture of third-party shops, arguing that these places use low-quality parts, install them improperly, and grift their customers. This couldn't be further from the truth. In reality, most independent repair shops are no different than your friendly, local auto mechanic whom you recommend to your friends and family any chance you get. And many of them are fully capable of performing the same repairs that manufacturers do—plus some repairs the manufacturers *won't* do.

Independent Shops Are Often as Good as the Manufacturers—If Not Better

Manufacturers constantly tell us that those who are properly trained, “authorized,” or “certified” by said manufacturers are the only ones who should be repairing our devices. But more often than not, independent repair shops are just as “properly trained” as anyone to fix your broken stuff.

Many independent repair technicians have gone through the same training and certification processes that manufacturers require out of their own technicians. It's also not uncommon for independent repair shops to have former technicians from big manufacturers on staff, especially from companies like Apple, HP, Microsoft, and others.

What's more, many common repairs don't require extensive expertise. You don't need years and years of training to replace a smartphone battery or a cracked screen. In fact, [we constantly receive success stories](#) from folks all over the world who have fixed their own device without any former training or knowledge. From retirees to teenage enthusiasts, our members are impressively capable. Obviously, you want your professional repair technician to be competent, but you don't need a master's degree in engineering and a handful of certifications to be good at fixing stuff.

Gabriel, who has been in the industry since 2002 and is currently the Operations Manager at [The Computer Cellar](#) in Durham, NC, can attest to this. “We've met teenagers that have walked into the shop and started discussing computers and technology with us and we've said to each other, ‘that kid could do our job,’” he says.

This is true even of those more complex repairs the manufacturers won't tackle. “One of our ex-techs joined us at 19 with only hobbyist experience,” Gabriel says. “When he left, he was teaching himself board-level repairs. He's now, at 22, pulling a better salary than me, plus some stellar benefits, working for a university.”

“Board-level” repairs involve fixing the circuit board itself by replacing individual components, instead of replacing the entire expensive circuit board. These advanced repairs require [microsoldering skills](#), specialized equipment, and a very steady hand.

So what about those repair parts that manufacturers keep harping on? Well, your local shop has a reputation to uphold. It's in their interest to use a reliable part that meets your high expectations. It's not too difficult to find aftermarket components that come from the same suppliers that manufacturers use.

Furthermore, a lot of shops will harvest the good parts out of other broken devices in order to get that coveted OEM logo. “When appropriately refurbished with good tools, these are great and are the best solution,” says Isaac.

In fact, we know that a lot of repair shops use high-quality parts, because in some cases, we’re the ones that supply those parts! Through our [iFixit Pro wholesale parts](#) program, we partner with independent repair shops and offer our parts, tools, and support so that those repair shops can offer their customers a great experience. All of our parts [are sourced from reputable, trustworthy suppliers](#), and we do [extensive in-house testing](#) on everything to make sure it’s up to snuff.

Independent Shops Can Perform Repairs That Manufacturers Won’t

Most manufacturers focus their repair training on the most frequent repairs. Apple, for example, won’t replace lightning ports in their stores—getting this service requires shipping your device to a dedicated Apple service center. It’s not uncommon for manufacturers to turn away repair jobs, either because it’s not worth their time and effort, or because they don’t have the proper tools and expertise to do the repair. Independent repair shops, however, are much more willing to do these more challenging jobs.

Isaac can attest to this, explaining that manufacturer technicians “are usually ‘good repairmen,’ but they don’t have the level that people repairing boards have, and will never have unless they train. So the Genius from Apple is even worse. He only knows how to use software that says a few things about the phone.”

[Josephine and Dave Billard’s experience with their water-damaged iPhone](#) is a great example. Here’s the short version: the couple wanted their photos recovered from an unresponsive iPhone, but Apple said they couldn’t help. They were able to find an independent repair shop ([iPad Rehab](#) near Rochester, NY) that could perform more complex board-level repairs, getting the phone up and running just long enough to back up the photos. Apple doesn’t have the necessary tools for jobs like this, so without this independent repair shop, Josephine and Dave would’ve lost their vacation photos forever.

We could spend all day sharing stories of manufacturers’ inability to perform repairs. Odds are you’ve run into this yourself!

“My own father-in-law experienced an unresponsive screen one random day with his [5th-generation iPod Touch](#),” says Craig Lloyd, former staff writer at iFixit. “Apple said they couldn’t fix it, so he ended up just buying a new iPod Touch.”

This kind of repair is [definitely possible](#), and a whole new screen assembly [is just \\$40](#). A local repair shop could perform this repair for much less than the cost of a new iPod Touch.

Consumers Should be Able to Decide Their Risk Tolerance

No matter what the situation is, there’s always going to be *some* risk involved during a repair, whether it’s a phone, car, refrigerator, or toaster. But for the most part, that risk is pretty low.

Going to a reputable and trustworthy independent repair shop is perhaps no riskier than bringing the device to the manufacturer itself. Again, many shops are highly trained and use high-quality

parts in their repairs. Plus, any good shop worth its salt will offer their own warranty on both the repair and the parts.

Finding a quality local repair shop is no different than finding a good, reputable auto mechanic. Ask for recommendations from friends and family who have patronized independent repair shops in the past—this is probably the best way to find a good shop that can service your broken device, as those who have gone through the same thing as you’re about to go through can provide valuable insight into a shop’s trustworthiness and level of customer service. We have found that pros who contribute to iFixit tend to run pretty fantastic businesses, and we have a [directory of them](#).

New Obstacles to Service in the Twenty-first Century

As the years have worn on, manufacturers have made more and more choices that prevent you from repairing your devices—some may be mere cost-cutting measures, while others are more egregious, locking you out for the sole purpose of preventing you from repairing your own device. Here are some of the most common examples.

Repair Restriction: Slapping “Warranty Void If Removed” Stickers on Your Product



Warranty void if removed sticker on a PlayStation 4.

When you crack open the back panel on your device—or perhaps even before—you’ll often find a sticker that claims your warranty will be void if you break the seal. But that’s illegal under the [Magnuson-Moss Warranty Act of 1975](#). A manufacturer can’t deny a warranty repair for, say, your screen just because you replaced your own battery. There are a lot of things manufacturers do to sort of passively-aggressively discourage you from fixing your stuff, but the warranty-void-if-removed stickers are much more overt. This law has gone unenforced for too long, but thankfully [the FTC has begun cracking down on this misleading practice](#)—though [many manufacturers are still doing it](#). In 2022, they [ordered](#) Harley, Westinghouse, and Weber to change their warranty practices.

A recent [US PIRG study](#) found that manufacturers are routinely flouting Magnuson-Moss with no-disassembly clauses in their user manuals.

Repair Restriction: Requiring Expensive Contracts for Security Updates

Availability of security updates and firmware for enterprise IT equipment is a major obstacle for the industry. Enterprise companies often require expensive support contracts in order to receive security patches. There is a long track record of monopolization of service in enterprise equipment.

In 1956, the DOJ charged IBM for violating antitrust laws. The [resulting consent decree](#) “enjoined and restrained [IBM] from requiring any purchaser of an IBM tabulating or electronic data processing machine to have it repaired or maintained by IBM or to purchase parts . . . from IBM.”

Oracle and Cisco also have restrictive firmware regimes. Cisco’s Smart Licensing System was introduced in 2014, but started [becoming mandatory](#) with the IOS XE 16.10.1a update in 2019. Cisco claims this allows for more flexible management of hardware licenses—but it also gives Cisco more control over hardware you’ve purchased.

Before Smart Licensing, switches were largely a set it and forget it deployment—you bought a piece of hardware along with a license to use the software on it. If you sold that hardware, the license went with it. Third-party companies could help you maintain your equipment when you ran into problems, even if the manufacturer had deemed the product End of Life for first-party support.

More importantly, since the license resides on Cisco’s servers, and “Cisco will be in charge of whether the unit works or not,” Todd Bone, founder and president of XS International, a third-party IT maintenance company, explained to iFixit. They could change their minds later on and limit your ability to use hardware you thought you owned.

Units managed via Smart Licensing also cannot be resold, which the Association of Service, Communication, Data, and ITAD Providers ([ASCDI](#)) identifies as a serious threat to refurbishment operations. Smart Licensing, [Bone writes for ASCDI](#), “will restrict the ability to buy refurbished hardware” and “eliminate residual value on your hardware purchases.”

Security updates should be distributed as widely as the products themselves are, particularly for critical cyber infrastructure. Short-sighted profiteering is putting our infrastructure at risk.

Repair Restriction: Diagnostic Software

In 2016, Apple confirmed that a software update had been quietly killing phones repaired outside of their “authorized” service network. Initially, the software giant defended “Error 53” as a security measure—and put the blame on independent repair shops and shoddy parts. Consumers, DIY hobbyists, and repair pros called out Apple for misrepresenting the facts. Apple apologized, admitted that Error 53 was a software mistake, and issued a software patch that fixed phones “bricked” by the error.

Apple reversed its position because consumers and repair professionals took a stand. It was a clear victory for the right to repair your stuff. But they continue to indicate that this software may be necessary for [repairs going forward](#): “MacRumors obtained an internal document from Apple

stating that Macs with the Apple T2 chip, including the iMac Pro and 2018 MacBook Pro, must pass Apple diagnostics for certain repairs to be completed.”

Apple is not the only one limiting access to diagnostics. Farmers need access to John Deere’s diagnostic software to debug their equipment. Deere doesn’t make it available to anyone except their authorized technicians, driving farmers to extreme options. A Motherboard investigation found [underground forums trafficking in pirated diagnostics](#):

“Once I was on it, I found dozens of threads from farmers desperate to fix and modify their own tractors. According to people on the forums and the farmers who use it, much of the software is cracked in Eastern European countries such as Poland and Ukraine and then sold back to farmers in the United States. ... ”

“Farmers worry what will happen if John Deere is bought by another company, or what will happen if the company decides to stop servicing its tractors. And so they have taken matters into their own hands by taking control of the software themselves.”

The cybersecurity of our food supply chain would be better served by direct sources of this software.

Repair Restriction: Parts Pairing

One significant obstacle to repairing software-enabled products is parts pairing, the practice of requiring remote authentication to enable a new part. Many manufacturers do this, from John Deere to General Motors to Apple. This practice effectively enables manufacturer control of every single repair, in dramatic contrast to how the free market of resale and repair has traditionally functioned.

Apple’s new consumer repair program is [limited by software locks](#). Parts sold through Apple’s Self-Service Repair Program are paired with the device’s serial number at the factory. To purchase a part, a customer must input their phone or laptop’s serial number; if they try to install that part in another device, it won’t work.

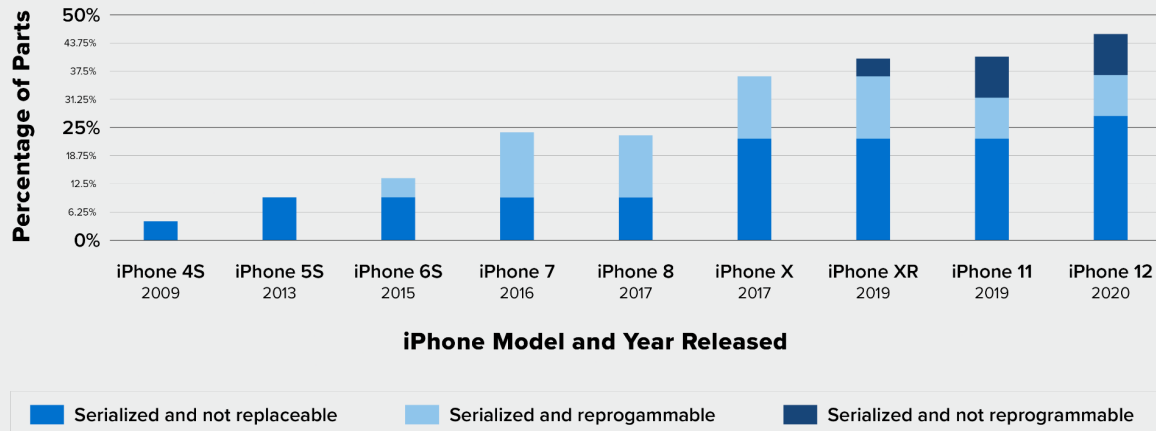
Apple’s new consumer repairs program, launched in 2022, allows only a limited, serial number-authorized set of repairs. You cannot purchase key parts without a serial number or IMEI. When you’re done installing the part, you need to pair it with the phone you indicated in your purchase, via over-the-air configurator software Apple support enables through chat.

If you use an aftermarket part, there’s an “unable to verify” warning after installation. This strategy hamstringing professional third-party repair with feature loss and scare tactics and could dramatically limit options for recyclers and refurbishers, short-circuiting the circular economy.

Requiring parts pairing essentially puts an expiration date on iPhones. When a refurbisher gets a functioning phone with no parts support, there will be no way for them to fully restore a product that needs a display replacement—even if they have an original Apple display from another phone.

iPhone parts pairing is getting worse

Each model has had more serialized parts



For now, parts pairing makes doing many repairs outside Apple's systems annoying but not impossible—a third-party battery will still work, although for several days the phone will display warnings, there will permanently be a red notification in the settings, and the battery health indicator might not work. Some repairs are impossible outside of the Apple store: For instance, to keep FaceID working on a new iPhone display, the repairer has to move over the original camera module. If that camera module is broken, or the fragile FaceID components get damaged in the transfer, nobody can complete the repair outside of Apple—and [Apple will charge](#) nearly the cost of a new phone for that repair. True Tone and auto brightness functionality is disabled after a screen replacement conducted outside an Apple store, even when using an original Apple screen.

But the lurking risk of parts pairing is that it essentially [builds a kill switch](#) into the device. If Apple wanted to disallow third party parts entirely, they have the technological means to do so. Apple has released updates that have had the effect of bricking or limiting phones fixed with third party parts (see [the Error 53 debacle](#) and the [iPhone 12's unswappable rear camera](#)).

Though Apple is the most famous parts pairing offender, lots of other manufacturers have taken this page from their playbook. Devices ranging from chainsaws to washing machines to tractors use serialization to keep parts under manufacturers' control.

It's not just Apple

Lots of products limit repair through paired parts.



Chainsaws

Only dealers can update firmware on new parts for Husqvarna chainsaws and automowers.



TVs

On many TVs, mainboards, t-con modules and panels must be paired via a hidden routine.



Xbox One

The Xbox disc drive is paired to the motherboard, so replacing one means replacing both.



PS4/PS5

Sony took a cue from Microsoft and also paired the PlayStation disc drive with the motherboard.



Food Processors

When a Thermomix food processor throws an error, only official Vorwerk technicians can get the software to reset it.



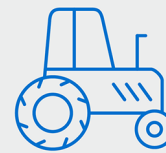
Washing Machines

Many appliances require access to expensive manufacturer software to calibrate replacement parts.



Cars

Some parts are VIN locked, or paired to a car's serial number, requiring a dealer to program replacement parts.



Tractors

Replacing some parts on John Deere tractors requires dealers to input a code to get the tractor out of "limp mode."

Repair Restriction: Wireless Telematics

Who owns our vehicles? The answer used to be obvious. But with the advancement of [telematics](#), safety, usage, location, system health, error codes and other data from a car are now tied to cloud services controlled by the manufacturer, so the answer has changed. Manufacturers can shut off remote services at any point and render hardware inoperable, and modifications to software to restore functionality can be illegal under DMCA Section 1201. These restrictions are impacting more people than ever before because the line between hardware and software, physical and digital, has blurred.

Telematics is simply the remote transmission of information from a product to a remote computer. The current legislative and court battle is over automotive telematics, but the fundamental principles apply to all products. VanMoof, a Dutch bicycle manufacturer, is currently undergoing a bankruptcy proceeding and [bicycle owners fear](#) that they won't be able to operate their bicycles when the remote servers shut off. Apple and John Deere's parts pairing technologies require a remote authentication from their servers before a new part is fully operational.

Using, repairing, and modifying modern products requires access to information: code, service manuals, error codes, and diagnostic tools. Silicon and telemetry permeate and power almost everything we own.

Access to telematics is a property rights issue. Who has the right to the data from our products? Should we be able to reprogram devices to talk to our own servers, rather than the manufacturer's?

The current state of affairs is biased against product owners, turning regular people — like students, researchers, and small repair business owners — into criminals. Fortune 500 telecom manufacturer Avaya, for example, is known for [suing IT service companies](#), accusing them of violating copyright for simply logging in to their customer's phone systems. With modern telematic systems, automotive manufacturers could use the same techniques to prevent independent management and service of automobiles.

Independent repair shops and software developers can only innovate around open products. The process to create new repair services and apps is only possible if the design is open and supports new ideas, products, and markets. Unfortunately, the manufacturer's approach to telematics has been anything but transparent.

Our industry, and the members that we serve, need to be able to access telematics information. Product owners' data should be used to serve more than the narrow commercial interests of a few large corporations.

If this information was available, then governments, researchers, and software startups would be able to innovate with it. They could build pro-active repair apps to help people maintain their equipment more effectively. Imagine if consumers had the information that their vehicle emissions were spiking, and could proactively get it fixed rather than waiting for a smog check. Innovative companies could develop monitoring applications for fleets of equipment.

Open data breeds innovation. Guaranteeing access to telematics information will benefit local innovators, consumers, and the environment.

Manufacturers are unfortunately using new technology to prevent users from accessing their data and repairing or modifying the devices they have bought, from tractors to printers to coffee makers. They are invoking vague 'intellectual property' concerns to justify and protect these anti-consumer behaviors.

These concerns are outweighed by the urgent needs of citizens to maintain their equipment. Property owners should have control over how their property is repaired or modified.

Right to Repair will enable better security. Security professionals agree that if the security of a product relies on nobody knowing how it works, it is much less likely to be effective. Opponents of the Right to Repair appeal to "[security through obscurity](#)" as a justification to [keep products closed](#), even though this approach has been discredited by the security community. [Kerckhoffs's principle](#) states that a cryptosystem should be secure "even if everything about the system, except the key, is public knowledge."

Repair Restriction: Using Rare or Proprietary Screws



Most people don't have a tri-wing screwdriver lying around in their garage to open Amazon's Fire TV gaming controller..

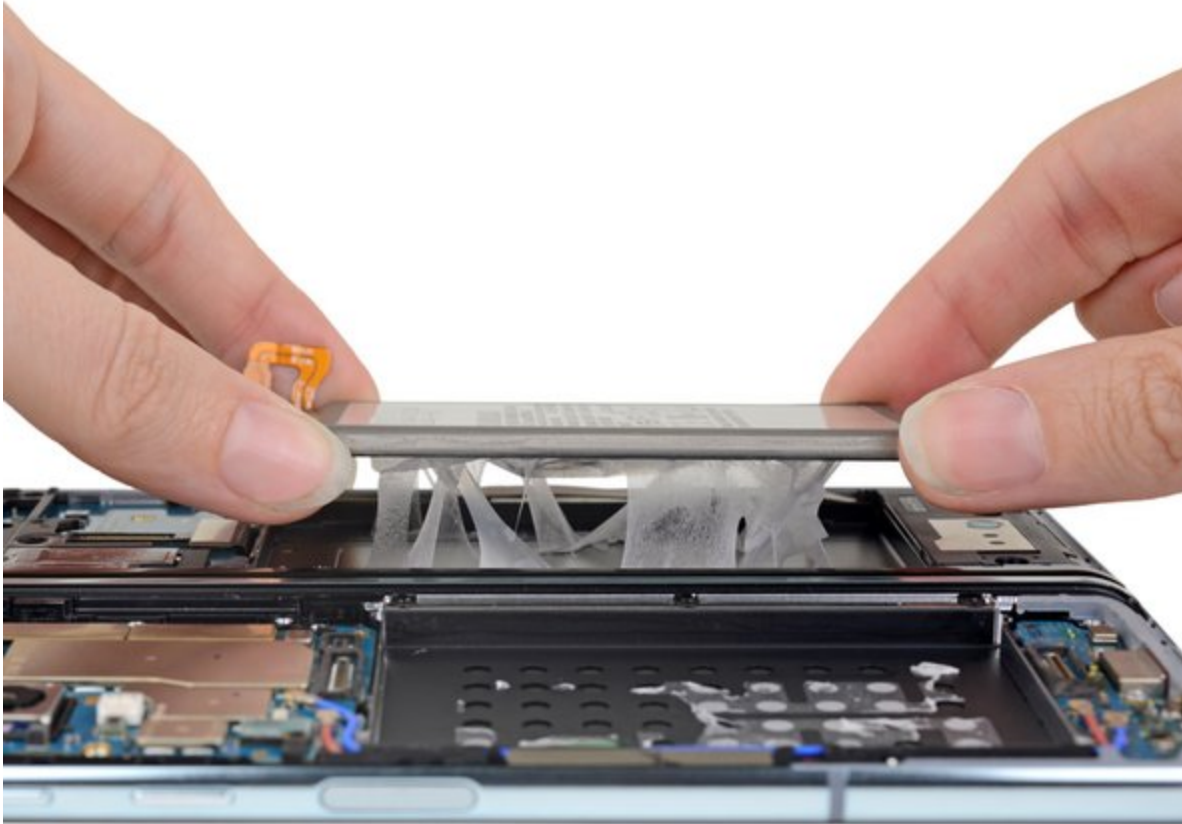
Everyone has a screwdriver at home, and some tech-savvy individuals may even have a set of [torx bits](#) in their toolbox. But manufacturers are increasingly using even harder-to-find screws that prevent you from getting inside your device.

“The easiest one to pick on is Apple, because they picked a screw design so obscure we’d never even heard of it,” says Jeff Suovanen, Senior Teardown Engineer at iFixit. “And we know it wasn’t for engineering reasons, because the iPhone got along fine with ordinary Phillips screws—until all of a sudden the [iPhone 4 switched to pentalobe screws](#). But only on the outside—none of the interior screws were changed. Since no one had a pentalobe driver, the clear intent was to tamper-proof your iPhone.”

Apple isn’t the only manufacturer to do this, of course—Nintendo was doing it all the way back in the 80s with a [special security bit](#) on NES cartridges and, later, on [the Super Nintendo](#). These kinds of lock-out moves have only proliferated. These days, Nintendo [uses rare tri-point screws on their hardware](#), Amazon [uses tri-wing screws on the Fire TV](#), and Sony [uses Torx security screws in the PlayStation 4](#).

“Torx security screws are some of the most frustrating ones, because a lot of people have torx drivers in their toolbox,” says Suovanen. “But manufacturers take that extra little step and use a [torx security](#) bit—which again, adds nothing engineering-wise to the device. It’s just an attempt to keep you out.” Some manufacturers don’t go quite this far, but will still [hide screws under rubber pads or other panels](#).

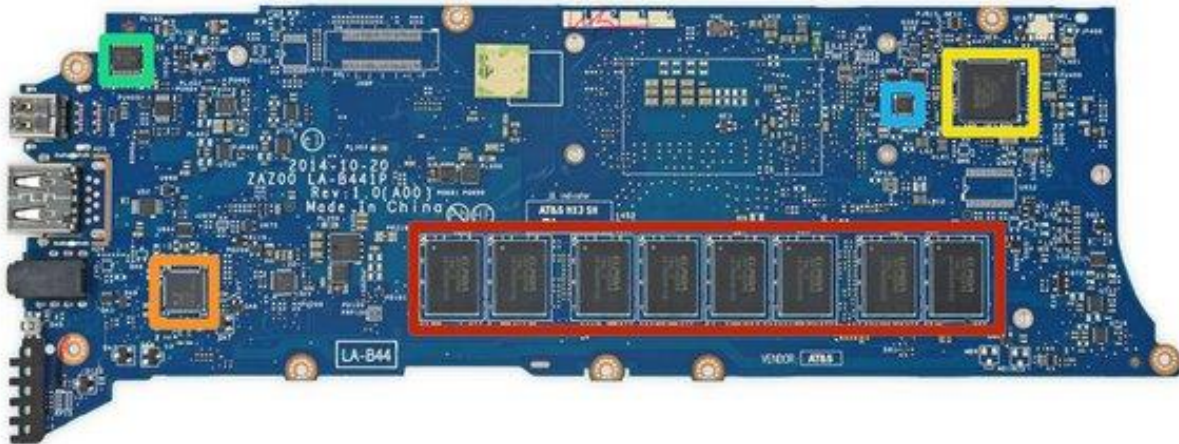
Repair Restriction: Gluing Instead of Using Screws



The [Samsung Galaxy Fold has two batteries](#), both held down with gobs of industrial adhesive that can only be removed with the help of a solvent.

In the age of sleek, curved devices with no obvious seams, [many manufacturers have turned to glue](#) instead of screws to hold things together. “There are legitimate reasons to use glue—like waterproofing,” says Suovanen. “But there is almost always a better way, like using screws and gaskets. Glue is very difficult to work with if you’re trying to repair something. It’s difficult to separate without breaking things, and it’s a pain to replace.” And when you use glue to hide those seams, it makes the device appear impossible to open, disincentivizing users to repair their device, instead of grabbing the ol’ Phillips head and taking a look inside.

Repair Restriction: Soldering Components Together to Make Upgrades Impossible



[The Dell XPS 13](#) is one of many laptops with RAM soldered directly onto the motherboard.

Once upon a time, you could open up your laptop, pop in some new RAM or a bigger hard drive, and get an extra couple years out of your computer. But that's often not the case anymore. "We've grudgingly accepted that most mobile CPUs are soldered onto the motherboard these days, and frequently that's the only option the manufacturer has—that's how they come from Intel," says Suovanen. But RAM and storage are often soldered to the motherboard unnecessarily, eliminating the possibility of otherwise easy upgrades. "There's no reason why you can't have a very thin, very light device with modular RAM and a removable blade SSD. We know because we've seen it done in devices like the [LG Gram](#) and the [HP EliteBook line](#) (which is [particularly repair-friendly](#))." When you see a label that says "no user serviceable parts inside," you know the manufacturer has soldered everything together and you have no chance of squeezing a few extra years out of the device when it slows down.

Repair Restriction: Making It Impossible to Disassemble a Device Without Destroying It



Good luck trying to put this Microsoft Surface Laptop back together.

In the most egregious cases of planned obsolescence, manufacturers will make a device difficult or impossible to open—at least, without inflicting irreparable damage. “The [Surface Laptop](#) is one of the only devices that we’ve awarded a 0 out of 10 in repairability, because it was so obvious that it was designed never to be taken apart or serviced—even by professionals,” says Suovanen. “In a nutshell, Microsoft [ultrasonically welded](#) the chassis together and then glued a fabric cover down over the top. There’s no way to take that apart without destroying it. You could put it back together with a roll of duct tape, but that’s about it.” That means if your device breaks, you’re completely out of luck—the manufacturer may give you a new device under warranty, but if your warranty has ended, you’re basically stuck buying an entirely new laptop.

In our Answers forum, one member's question about [how to fix the broken glass](#) on your Microsoft Surface has been viewed over 30,000 times. Another member asked whether they could [upgrade the RAM on their Surface](#)—proving that they want to hold onto their device instead of buying a new one—and racked up another 30,000 views. In both scenarios, there is no repair solution.

In 2021, Microsoft reached a groundbreaking settlement with shareholders: it committed to studying the environmental impact of making parts and repair information available to shops and individuals, and implement the findings of that study within the next year. Microsoft also pledged to activist shareholder As You Sow to make parts available outside its authorized repair network, and “initiate new mechanisms” to give consumers local repair options.

Microsoft commissioned a [report looking at the impact of design for repair on their products](#) by Oakdene Hollins, who found that “all forms of repair offer significant greenhouse gas (GHG) emission and waste reduction benefits. It also found that enabling repair through device design, spare part offerings, and localization of repair have significant potential to reduce carbon and waste impacts.”

Microsoft has followed through on this report and [completely redesigned](#) the Surface Laptop to make it easier to service, radically improving the ease of repair.

Repair Restriction: Refusing to Sell Replacement Parts



iFixit's [iPhone X](#) battery service manual. The battery is securely glued in place.

Design choices aren't the only way manufacturers prevent repair. Many companies, for example, choose not to offer official replacement parts to individuals or repair techs. “We're used to being able to buy replacement parts for our cars and appliances, but that's often not the case with your smartphone or laptop,” Suovanen says. And when manufacturers refuse to sell Original Equipment Manufacturer (OEM) parts, repair shops and users have to turn to third-party components instead, which can be problematic.

“It's very hard to find good parts when the market is flooded with low-quality imitations that don't perform well. In the case of batteries in particular, some of those third-party components can be dangerous—a cheap battery can destroy your device, or burn down your house.” Here at iFixit, we do the legwork for you, sourcing the highest quality parts we can find and testing them thoroughly before selling them in [our store](#). But if you search for a replacement battery

elsewhere, there's no guarantee of what you'll get. This whole process would be much easier and safer if people were able to buy official parts directly from the manufacturer.

That should change as a result of the New York and Minnesota laws, which require manufacturers to sell parts to consumers and independent shops, and will be phased in starting in 2024.

Even when you *can* find an OEM part, some manufacturers put restrictions in place that prevent you from using it to the fullest. “If you [replace the screen on your iPhone](#)—even if it's with a brand new OEM screen off of another identical iPhone—certain features like TrueTone won't work correctly,” says Suovanen. This compels users to go directly to the manufacturer for repairs, no matter what they cost.

Repair Restriction: Claiming Repairs Are Impossible or Too Expensive



Removing an iPhone circuit board to recover the data, a service that Apple does not provide.

Finally, manufacturers will falsely tell users that certain repairs can't be done, even when independent shops are perfectly capable of performing them. “People go to the Genius Bar with very common problems that our repair community knows how to fix, but Apple tells them it can't be done,” says Suovanen. For example, Apple [won't help you recover data on a water-damaged iPhone](#), and they won't refer you to third-party repair shops who can. In other cases, they may quote a repair price that's high enough that most customers will just throw up their hands and buy a new device.

The Failure of Green Standards to Inform Repairable Device Design

Tech companies are standing in the way of stronger green electronics standards in the US, according to a report by Repair.org. It finds that device manufacturers have systematically blocked attempts to promote longer-lasting, more repairable devices.

Green electronics standards help people identify sustainable products and reward manufacturers that incorporate green designs. New products are scored against environmental performance criteria and are included on the [EPEAT registry](#) with a Bronze, Silver, or Gold designation. Eco-minded buyers—including the US government—rely on the EPEAT registry to guide billions of dollars in purchasing.

But manufacturers have been watering down the standards, as detailed in an analysis—[Electronics Standards Are In Need of Repair](#)—commissioned by Repair.org. The standards are supposed to be written by a balanced group of volunteer stakeholders, including representatives from major electronics producers. But manufacturers now occupy a large number of seats on the standards boards. They are abusing their position, diluting the standards to meet their existing products instead of designing leadership standards that encourage better products.

Despite overwhelming consensus that extending product lifespans is better for the environment, tech companies have largely blocked efforts to award points for products that are easier to repair, easier to upgrade, and easier to disassemble for recycling.

Instead of leading the way, green standards in the US “have become a complicated way for manufacturers to greenwash products that have a devastating environmental impact and pat themselves on the back for business as usual,” the report concludes.

State-level Efforts to Restore Our Right to Repair

This section outlines four steps that state legislation is taking to increase access to repair options across America.

Make Service Manuals Public

To keep electronic devices working for as long as possible, recyclers, professional technicians, and home repair experts need information about how to safely and successfully disassemble their electronics. Publishing comprehensive service documentation will extend electronics’ usable life better than any other single action.

These manuals should include exploded diagrams of parts, compatibility charts, wiring diagrams, step-by-step disassembly instructions with required tools, product specifications, maintenance procedures, and troubleshooting information. When good repair documents are freely and easily available, people will fix their old devices instead of buying new.

Fortunately, almost all manufacturers already have this information, and could enact real, immediate change by simply making it publicly available. Historically, manufacturers always provided this information to their customers. Recently, though, some companies have chosen to treat service documentation as proprietary information and guard it from public view. Apple in

particular is known for using copyright law and legal threats to prevent retransmission of their service manuals.

Dell, HP, and Lenovo already make their documentation public, which has helped create tens of thousands of repair jobs. Apple and Samsung have started to open up their documentation. But it would be more effective if technicians could reproduce the documentation the way that foreign technicians do. Fixing this copyright issue would bring us up to par with where the Chinese are now.

Make Circuit Diagrams Public

Repair isn't always a matter of simply swapping out trouble components. When complex components fail, they should be fixed instead of sent off for recycling. Board-level repairs require circuit schematics, which include component layout and electronic wiring diagrams. These documents make it possible for technicians to replace individual capacitors, for example, instead of scrapping an entire circuit board. Since circuit diagrams are largely standardized for international use, these diagrams are especially useful to aftermarket refurbishers overseas, where much of the component-level repair actually takes place.

These schematics are in high demand by technicians. iFixit received a DMCA takedown notice from Apple on December 8, 2015, demanding the removal of a circuit schematic uploaded by a community member for a MacBook Pro logic board. YouTube personalities [Louis Rossman](#) and [Jessa Jones](#) post popular training videos for technicians using schematics that are not available through legal means.

The circuit diagram should include the approved vendor list, or AVL, and Bill of Materials (BOM) detailing the specific part number and manufacturer for each component. It's important to know precisely which parts are needed.

The [capacitor plague](#) caused millions of electronics over the last twenty years to fail prematurely. The parts needed to fix the failing devices usually cost less than \$1, but knowing which parts to buy requires access to manufacturer information. Because this information is not available, relatively few machines have been repaired. Most were shredded. Some particularly savvy repair technicians have reverse engineered the circuit and created informal diagrams, which vary widely in quality and availability. Authoritative circuit diagrams would make component repair more attainable for both professional technicians and do-it-yourselfers.

Make Semiconductor Documentation Datasheets Public

Microchips are the most toxic part of electronic devices. Massive amounts of [high-purity water](#), [electricity](#), and [toxic chemicals such as arsenic](#) are used in semiconductor fabrication. Despite the enormous environmental costs, microchips are everywhere—from [children's toys](#) to [complex computers](#).

Running any functional chip through a shredder is a massive waste of resources. Even when a device is beyond repair, chips can be recovered and repurposed. Made widely available on the internet, semiconductor engineering documentation would allow technicians around the world to recover microchips and reuse them in other devices.

Make Service Parts and Tools Available to Third Parties.

[California law](#) requires manufacturers make a service option available for seven years after the sale of a device. Manufacturers generally comply with this by providing repair service for a fee, rather than selling parts to independent service technicians and consumers.

Without access to OEM parts, service technicians are reliant on gray market parts and parts scavenging, where they pull parts from non-functional devices.

The new New York and Minnesota laws will require manufacturers to sell parts directly to consumers, and many manufacturers are starting to do so. Apple, Samsung, Google, Microsoft, Logitech, HTC, Valve, and Motorola are among companies starting to make parts available.

Conclusion

A robust repair market creates and expands job opportunities in the US, keeps reusable and repairable products out of the waste and recycling streams, and gives consumers more options for what to do with a malfunctioning product.

Over the last few decades we've gone from a world where software is rarely seen outside of a general-purpose computer, to a world where billions of microprocessors are embedded every year in virtually every type of device. Essentially all categories of manufactured products, from lightbulbs to toothbrushes, now contain software that is central to their functionality. As a result, software has also become central to their repair. Manufacturers are, unfortunately, taking this opportunity to prevent users from repairing or modifying the devices they have bought, from tractors to smartphones.

Americans expect to be able to tinker with and repair their devices. Allowing more people to repair devices is a broad public good that is hindered by a number of companies' short-term focus. We can, and should, do better.

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